

Nov. 13, 1951

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2,574,631

CONSTANT PRESSURE CENTRIFUGAL PUMP

Filed April 28, 1950

2 SHEETS—SHEET 1

Fig. 1.

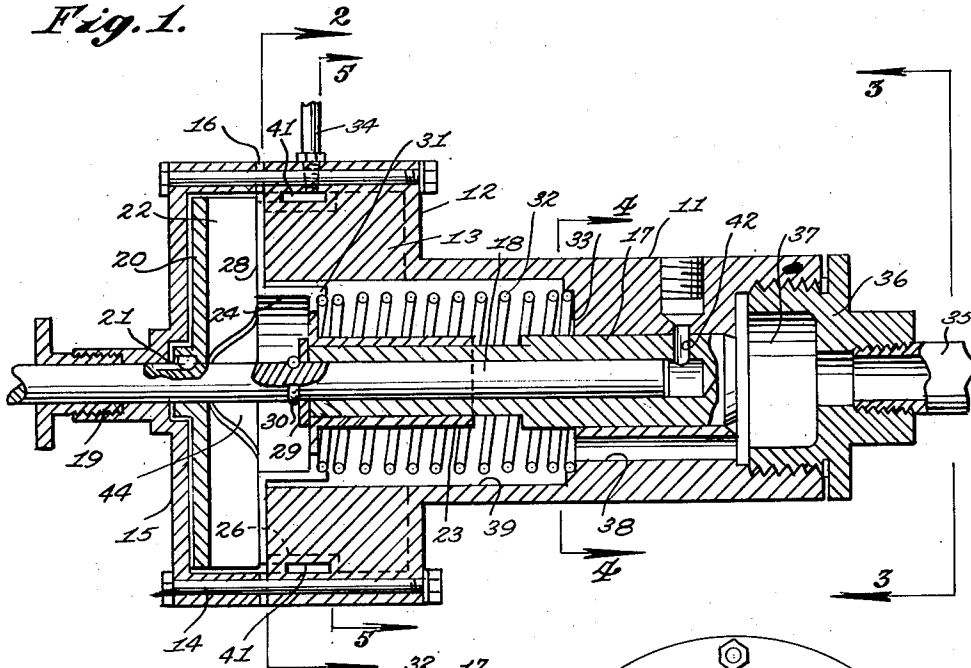


Fig. 4.

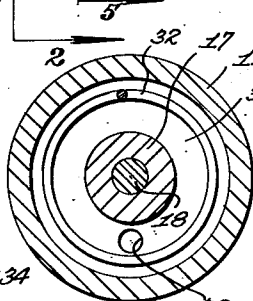


Fig. 2.

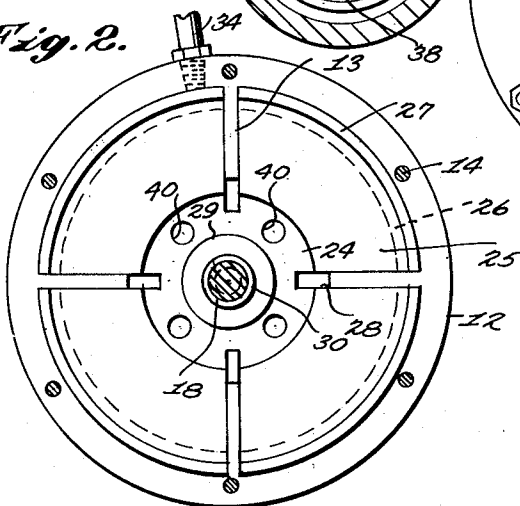


Fig. 3.

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2 SHEETS—SHEET 2

Fig. 8.

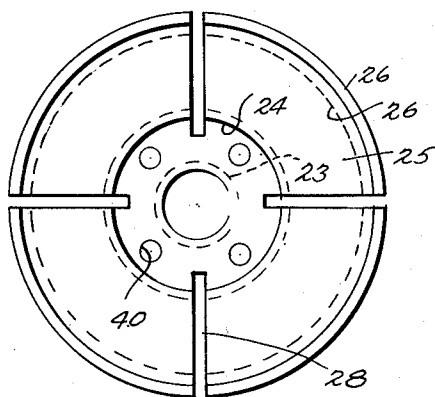


Fig. 9.

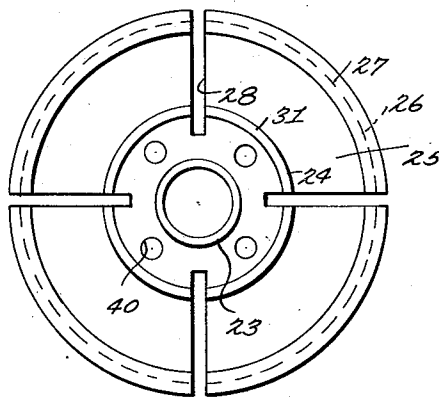


Fig. 5.

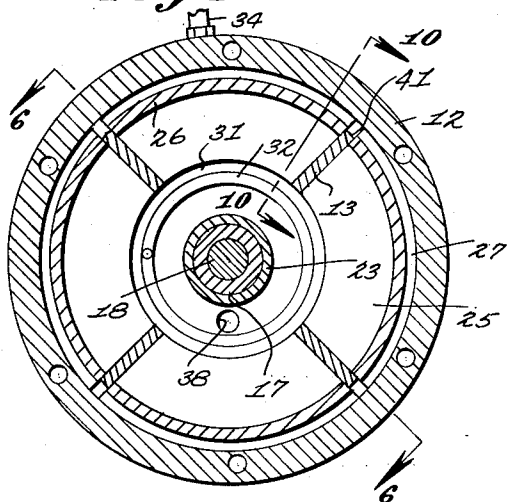


Fig. 6.

Fig. 7.

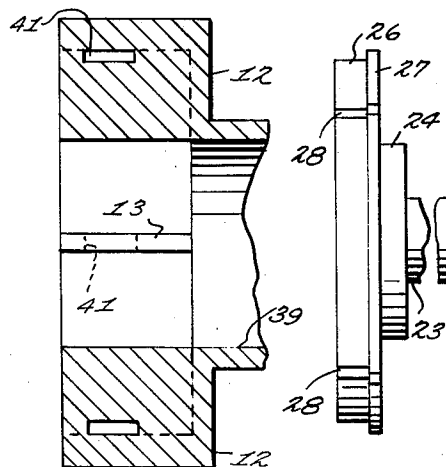
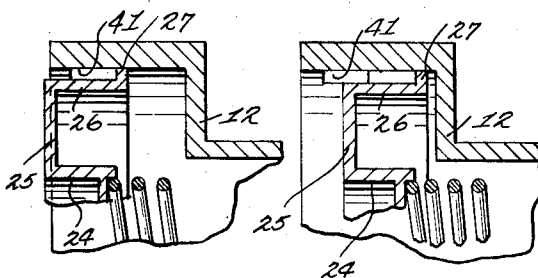


Fig. 10.

Fig. 11.



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CONSTANT PRESSURE CENTRIFUGAL PUMP

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Application April 28, 1950, Serial No. 158,769

3 Claims. (Cl. 103—42)

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This invention relates to centrifugal pumps, and more particularly to a centrifugal pump arranged to pump liquids at a constant pressure under conditions of varying rate of flow and at varying pump speeds.

A main object of the invention is to provide a novel and improved centrifugal pump which will provide substantially constant pressure under varying rates of liquid flow and under conditions of varying pump speeds, the pump being very simple in construction, being reliable in operation, and being especially suitable for use with internal combustion engines, for example engines of the type equipped with a float type carburetor wherein constant inlet pressure of a liquid fuel is required.

A further object of the invention is to provide an improved centrifugal pump adapted to provide a substantially constant outlet pressure under conditions of varying rate of liquid flow and at varying pump speeds, the pumps being inexpensive to manufacture, being rugged in construction, being easy to take apart for cleaning, and being easy to install in a fuel supply system.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a vertical longitudinal cross sectional view taken through an improved centrifugal pump constructed in accordance with the present invention.

Figure 2 is a vertical cross sectional transverse view taken on line 2—2 of Figure 1.

Figure 3 is a cross sectional view taken on line 3—3 of Figure 1.

Figure 4 is a cross sectional view taken on line 4—4 of Figure 1.

Figure 5 is a transverse vertical cross sectional view taken through the enlarged main body portion of the pump housing, said view being taken on line 5—5 of Figure 1.

Figure 6 is a cross sectional detail view of the enlarged portion of the pump housing, said view being taken on line 6—6 of Figure 5.

Figure 7 is a fragmentary side elevational detail view of the movable pressure regulating disc employed in the improved pump of Figure 1.

Figure 8 is an enlarged front elevational detail view of the movable pressure regulating disc employed in the pump, as illustrated in Figure 7.

Figure 9 is a rear elevational detail view of the movable pressure regulating disc of Figures 7 and 8.

Figure 10 is an enlarged cross sectional detail

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view taken on line 10—10 of Figure 5 showing the pressure regulating disc in its normal position.

Figure 11 is a view similar to Figure 10 but showing the pressure regulating disc moved to a position wherein the clearance adjacent the rotary pump and impeller blades has been increased under the influence of an increase in discharge pressure in the pump, whereby the pressure may be returned to its normal inlet pressure value.

Referring to the drawings, the pump comprises a main cylindrical body 11 formed with an enlarged annular forward portion 12 said annular portion 12 being provided with the inwardly extending radially directed ribs 13. Any desired number of ribs may be employed, four ribs being shown merely by way of example, the ribs being equally spaced around the axis of the housing. Secured to the enlarged annular portion 12 by means of the spaced peripheral bolts 14 is the flanged head or cover 15, a suitable annular gasket 16 being interposed between the meeting edges of the head 15 and the enlarged housing portion 12.

Secured axially in the rear portion of the housing 11 is a shouldered bearing sleeve 17, and rotatably mounted in said bearing sleeve is a shaft 18 which extends rotatably and sealingly through a gland 19 provided centrally in the head 15. Designated at 20 is an impeller which is rigidly secured on the shaft 18, as by means of a key 21, said impeller being provided with the radial impeller blades 22.

Slidably mounted on the reduced forward portion of the bearing sleeve 17 is a sleeve member 23 carrying in its forward end an annular drum member 24. Integral with the drum member 24 is the annular disc element 25, said disc element being rearwardly flanged at its periphery, as shown at 26, and being outwardly flanged at the end of the annular flange 26, as shown at 27. The drum 24, disc 25, flange 26, and flange 27 are notched radially, as shown at 28 and slidably receive the ribs 13. This prevents rotation of the flange 25 and the other elements of the pressure regulating disc with respect to the housing 11 but allows said pressure regulating disc to move axially in the housing. As shown in Figure 1, a washer 29 is mounted on the shaft 18 and held in position by a stop ring 30 secured on said shaft, the washer acting as a stop means to limit forward movement of the drum 24 by engaging the front wall of the drum, as shown in Figure 1. The annular peripheral surface of the drum element 24 extends rearwardly beyond the rear wall of said drum element, as shown at

31, and thereby defines a seat or recess facing rearwardly in the housing 11 to locate the end of a coil spring 32 mounted axially in the housing 11 and bearing at one end in the aforementioned recess seat and bearing at its other end in a recess seat 33 formed in the rear portion of the housing. Spring 32 therefore biases the pressure regulating disc assembly comprising the disc 25 and its associated elements to a position closely adjacent to the rear edges of the impeller blade 22. When the fluid pressure in the impeller space of the head 15 rises above a predetermined value, said fluid pressure acts on the pressure regulating disc member and forces said disc member rearwardly against the force of spring 32, thereby enlarging the clearance space adjacent the impeller blades. This permits the fluid pressure to restore itself to a predetermined stable value, determined by the strength of the spring 32.

Designated at 34 is an outlet conduit connected to the wall of the enlarged portion 12, said conduit being in communication with the impeller space of the pump. Designated at 35 is a liquid supply conduit connected to the rear end of the housing by means of a threaded fitting 36, the inner cavity 37 of said fitting communicating with the forward portion of the housing by a longitudinally extending passage 38 formed in the housing 11. Liquid may therefore flow into the housing through the conduit 35 and through the passage 38 to the bore of the housing 11, shown at 39, and then through the radial slots 28 of the pressure regulating disc assembly and the ports 40 to the portion of the impeller 20 between the impeller blades 22 and adjacent to the shaft 18. The shaft 18 is driven by any suitable source of power, such as by being coupled to the crank shaft of the internal combustion engine with which the pump is being employed, and the rotation of the impeller blades 22 causes the liquid to be rotated and produces centrifugal force on the liquid, thereby creating a relatively high pressure at the outer portions of the impeller. The degree of this pressure is controlled by the spring force on the pressure regulating disc 25, and as a result of axial movement of the disc 25 thereby changing the amount of clearance between the impeller blades 22 and the pressure regulating disc member and more particularly between the edges of the blades and the disc 25, and, as above described, when the pressure rises above a predetermined value the disc is moved rearwardly increasing said clearance and allowing the excess fluid to return to the inlet pressure chamber 44, thus allowing the discharge pressure to be stabilized at a predetermined value. Therefore, the pressure is maintained at a relatively constant value at the outlet conduit 34 under conditions of varying rates of fluid flow and also under conditions of varying speeds of rotation of the impeller shaft 18. For example, when the impeller speed increases to an excessive value, the pressure regulating disc moves away from the impeller, thereby permitting the internal circulation of the liquid from the high pressure region of the impeller to the low pressure thereof, thus alleviating the excessive increase in pressure caused by the increased speed of rotation of the impeller blades. By selecting a suitable value of spring force of the spring 32 a desired maximum pressure of liquid in the outlet conduit 34 may be maintained. Figure 10 shows the position of the pressure regulating disc member relative to the enlarged housing portion 12 when the impeller is at rest or is

rotating at an idling speed, thereby providing an output liquid pressure equal to or below the limiting maximum value. Figure 11 discloses the pressure regulating disc member in its rearwardly moved position responsive to high speed rotation of the impeller or other conditions tending to increase the pressure in the impeller space above the limiting value. It will be noted that in the position of Figure 11 the clearance space between the transverse plane of the rear edge of the impeller blades and the annular disc element 25 has substantially increased with respect to the conditions shown in Figure 1.

The rear wall of the drum element 24 of the pressure regulating disc member is formed with a plurality of openings 40 to provide substantially free flow of the inlet liquid from the rear portion of the bore 39 into the space 44 adjacent the central portions of the impeller 20. The inner portions of the slots 28 also serve as passages for allowing the liquid to flow through the pressure regulating disc member.

It will be noted that the ribs 13 divide the liquid discharged from the impeller into separate chambers. Since it is desired that all chambers contribute to the discharge of the liquid through the discharge conduit 34, slots 41 are formed in the ribs adjacent the inside peripheral wall surface of the enlarged housing portion 12, thereby constituting means for connecting all of the chambers defined by the ribs 13 to the discharge conduit. The ends of outwardly directed flange 27 of the pressure regulating disc member is set back sufficiently so that the openings 41 will not be obstructed at any time by the pressure regulating disc member, as shown in Figures 10 and 11. In Figure 10, the flange 27 just clears the rear end of the slot 41, and in Figure 11, the flange 27 has moved rearwardly from said slot 41. The effective area of the pressure regulating disc member is not decreased by setting back the flange 27 in the manner above described, inasmuch as the projected area of said pressure regulating disc member remains the same.

As shown in Figure 1, a lubrication passage 42 may be provided in the rear portion of the housing 11, whereby lubricant may be admitted into the bore of the bearing sleeve 17.

It will be further noted that the fitting 36 is formed with opposed flat surfaces 43, 43, facilitating engagement of said fitting by a wrench when it is desired to take the pump apart for cleaning or repair.

While a specific embodiment of a constant pressure centrifugal pump has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitation be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A centrifugal pump of the character described comprising a cylindrical housing, an annular enlarged portion at one end of said housing, a shaft rotatably mounted in said housing, a plurality of impeller blades carried on said shaft in said enlarged portion adjacent the end wall of the housing, a plurality of inwardly projecting radially extending ribs carried by the interior wall surface of said enlarged portion, a pressure controlled disc member slidably mounted on said shaft and extending adjacent to said blades, said disc member being formed with radial slots in

which said ribs are slidably receivable responsive to axial movement of said disc member, such axial movement occurring when the fluid pressure created by the blades exceeds a predetermined value, whereby increased clearance space is provided adjacent to the blades to reduce the fluid pressure, spring means biasing the disc member toward the blades and opposing axial movement of said disc member, said housing being formed with a fluid admission passage extending to the central part of said enlarged portion, a fluid outlet conduit connected to the side wall of said enlarged portion, said ribs being formed with longitudinal slots adjacent the interior wall surfaces of the enlarged portion, allowing substantially free flow of fluid through the ribs, stop means on said shaft limiting movement of said disc member toward said impeller blades, said spring means comprising a coiled spring surrounding said shaft and bearing between said disc member and said housing and arranged to oppose movement of the disc member away from said impeller blades.

2. A centrifugal pump of the character described comprising a cylindrical housing, an annular enlarged portion at one end of said housing, a shaft axially and rotatably mounted in said housing, a plurality of impeller blades carried on said shaft in said enlarged portion adjacent the end wall of the housing, a plurality of inwardly projecting radially extending ribs carried by the interior wall of said enlarged portion, a pressure controlled disc member slidably mounted on said shaft and extending adjacent the blades, said disc member being formed with radial notches in which said ribs are slidably receivable responsive to axial movement of said disc member, such axial movement occurring when the fluid pressure created by the blades exceeds a predetermined value, whereby clearance space is provided adjacent the blades to reduce the fluid pressure, spring means biasing the disc member toward the blades and opposing axial movement of said disc member, said housing being formed with a fluid admission passage extending to the central part of said enlarged portion, and a fluid outlet conduit connected to the side wall of said enlarged portion adjacent one of said ribs, said ribs being formed with longitudinal slots adjacent the interior wall surface of the enlarged portion allowing substantially free flow of fluid through the ribs to said outlet conduit.

3. A centrifugal pump of the character described comprising a cylindrical housing, an an-

nular enlarged portion at one end of said housing, a shaft axially and rotatably mounted in said housing, a plurality of impeller blades carried on said shaft in said enlarged portion adjacent the end wall of the housing, a plurality of inwardly projecting radially extending ribs carried by the interior wall surface of said enlarged portion, a pressure controlled disc member slidably mounted on said shaft and extending adjacent to said blades, said disc member being formed with radial slots in which said ribs are slidably receivable responsive to axial movement of said disc member, such axial movement occurring when the fluid pressure created by the blades exceeds a predetermined value, whereby increased clearance space is provided adjacent to the blades to reduce the fluid pressure, spring means biasing the disc member toward the blades and opposing axial movement of said disc member, said housing being formed with a fluid admission passage extending to the central part of said housing, said disc member being formed with a passage therethrough, communicating with said enlarged portion, a fluid outlet conduit connected to the side wall of said enlarged portion, said ribs being formed with longitudinal slots adjacent the interior wall surfaces of the enlarged portion, allowing substantially free flow of fluid through the ribs, and stop means on said shaft limiting movement of said disc member toward said impeller blades, said spring means comprising a coiled spring surrounding said shaft and bearing between said disc member and said housing and arranged to oppose movement of the disc member away from said impeller blades.

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